

### **REMARKS/ARGUMENTS**

Claims 1-11 are pending. Claim 11 was previously withdrawn. Claims 12 and 13 depending from claim 1 are newly added. Claim 1 has been amended to correct typographical errors and to be made more clear. Support for newly added claims 12 and 13 and the claim 1 amendments can be found in the specification and the original drawings. No new matter has been introduced.

Claims 1-8 were rejected under 35 U.S.C. 103(a) as being unpatentable over U.S. Patent No. 6,351,018 to Sapp.

Claims 9-10 were rejected under 35 U.S.C. 103(a) as being unpatentable over Sapp and further in view of U.S. Patent No. 6,437,386 to Hurst et al.

### **Amendments to the Drawings**

Figure 4B has been amended to correct an inadvertent error. As the attached copy of Fig. 4B from the originally filed informal drawings shows, layer 428C properly contacts the top surface of electrodes 410S. However, as shown in the attached copy of Fig. 4 from the formal drawings previously filed, in preparing the formal drawings a gap was inadvertently included between electrodes 410S and their overlying layer 428C. This inadvertent error has been corrected in the attached corrected replacement sheet. Thus, the drawing amendment does not introduce new matter, and entering of the drawing amendment is respectfully requested.

### **Amendments to the Specification**

The specification has been amended to correct typographical and inadvertent errors. One inadvertent error occurred in paragraph 3 of the specification wherein the second occurrence of "U.S. Patent No. 5,111,253" to Korman et al. is mistakenly attributed to Sapp. The Korman et al. patent and the Sapp patent (U.S. No. 6,351,018) were correctly identified in the Information Disclosure Statement that accompanied the instant application. In light of the inclusion of Sapp within the

Information Disclosure Statement and the reference to Sapp within the body of the specification, applicants respectfully request entry of this amendment to the specification.

**Claim Objections**

Claim 1 was objected to for including two periods. Claim 1 has been amended to replace the first period with a comma. Withdrawal of this objection is respectfully requested.

**Drawing Objections**

The drawings were objected to for failing to show a trench with "a thicker insulating layer along its bottom than along its sidewalls" recited in claims 9 and 10. The Applicants respectfully disagree because Figs. 4A and 4B provide the necessary support for the referenced claim language. For example, Fig. 4B shows trenches with a thicker insulating layer along their bottom than along their sidewalls adjacent electrodes 410 and 410S. Accordingly, withdrawal of this objection is respectfully requested.

**35 U.S.C. §103 Obviousness Rejections**

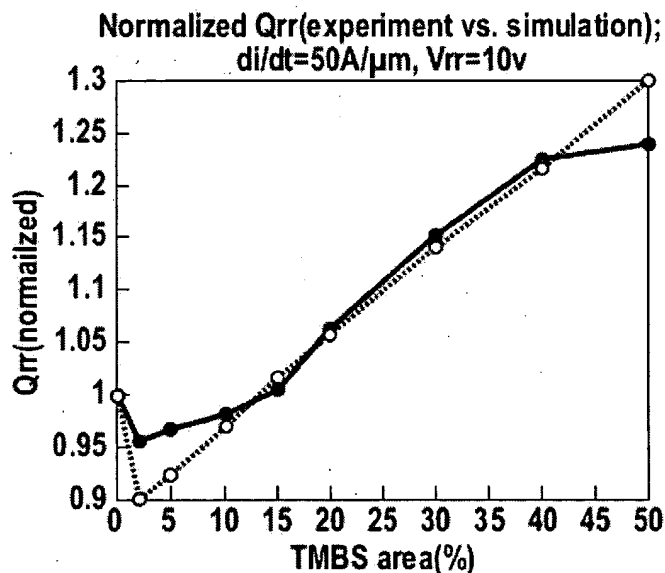
All claims currently pending stand rejected as obvious under 35 U.S.C. §103 in view of Sapp (USPN 6,351,018) alone or in combination with Hurst et al. (USPN 6,437,386). This is respectfully traversed.

The Office action indicates that Sapp shows all the features of claim 1 except for the claimed 2.5% to 5% range, and that the claimed range does not appear to be critical and is thus obvious. The Office action further indicates that the critical nature of the Schottky structure consuming 2.5% to 5% of the active area of the device is not disclosed within the specification. Applicants respectfully submit that the critical nature of the Schottky structure consuming less than 5% of the active area of the device is in fact disclosed within the specification in several locations.

In paragraph [0030] of the specification, Applicants state:

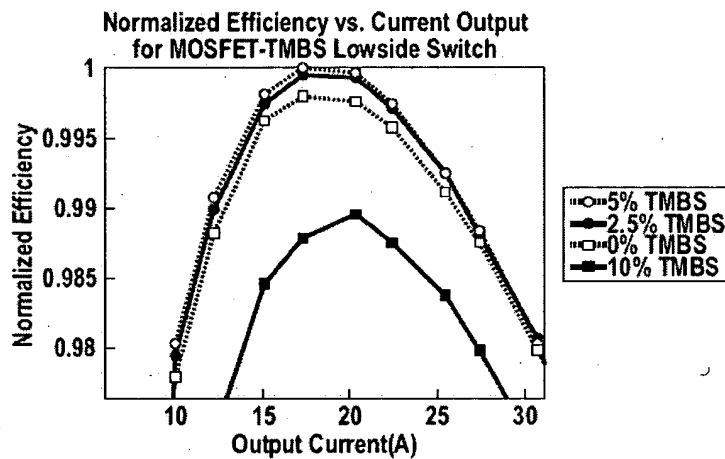
The inventors have discovered, based on the simulation results as well as silicon data, that there is an optimum contribution of the Schottky structure area which maximizes the performance of the integrated device. More specifically, it has been discovered that a ratio of the total area of the Schottky structure to the total area of the MOSFET in the range of 2.5% to 5% results in optimum performance. In an exemplary embodiment wherein the MOSFET cell pitch is 2.5m and the pitch of a Schottky structure or a TMBS cell is 5m, a 2.5% ratio is obtained by forming one TMBS cell every 40 MOSFET cells.

The performance improvements resulting from the claimed range are documented in a number of places in the application. The amount of stored charge  $Q_{rr}$  for a Schottky diode has a significant effect in delaying the diode turn off. The delay time between the idealized turn-off time and the actual turn off time is called the reverse recovery time. As shown in Fig. 10 of the application reproduced below, the amount of stored charge  $Q_{rr}$  is at a minimum point "at about 2.5% Schottky structure contribution and rises rapidly with increasing Schottky sctructure area" (paragraph [0034]). Fig. 10 clearly shows that the stored charge  $Q_{rr}$  is at minimum levels for Schottky structure contributions of less than 5%.



**FIG. 10**

Fig. 11 of the application reproduced below further reinforces the criticality of the Schottky structure consuming less than 5% of the active area. Efficiency values for a range of output currents are shown for different Schottky structure contributions. As can be seen, the low-side switches with less than 5% Schottky structure contribution possess the highest values for normalized efficiency.



**FIG. 11**

Accordingly, Applicants respectfully submit that the critical nature of the claimed range of Schottky structure area is clearly set forth in the specification and the drawings and thus request withdrawal of rejection of claim 1 and its dependent claims 2-10 and 12-13.

### CONCLUSION

In view of the foregoing, Applicants believe the pending claims 1-10 and newly added claims 12 and 13 are in condition for allowance. The issuance of a formal Notice of Allowance at an early date is respectfully requested.

Appl. No. 10/801,499  
Amdt. dated April 20, 2006  
Reply to Office Action of October 20, 2005

PATENT

If the Examiner believes a telephone conference would expedite prosecution of this application, please telephone the undersigned at 650-326-2400.

Respectfully submitted,



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Attachments  
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**Amendments to the Drawings:**

The attached **replacement sheet** of drawings includes changes to **Fig. 4B**. This replacement sheet, which includes Figs. 4A and 4B, replaces the original sheet including Figs. 4A and 4B.

Also attached is an **annotated sheet showing changes** made to the first formal replacement drawing filed on July 29, 2004 wherein the draftsman's inadvertent error was made, and the sheet of **informal** drawings as originally filed in the application on March 15, 2004. Comparison of originally filed informal Fig. 4B and the current replacement Fig. 4B will show that the amendment to the drawing does not introduce new matter.

Attachment: Replacement Sheet  
Annotated Sheet Showing Changes

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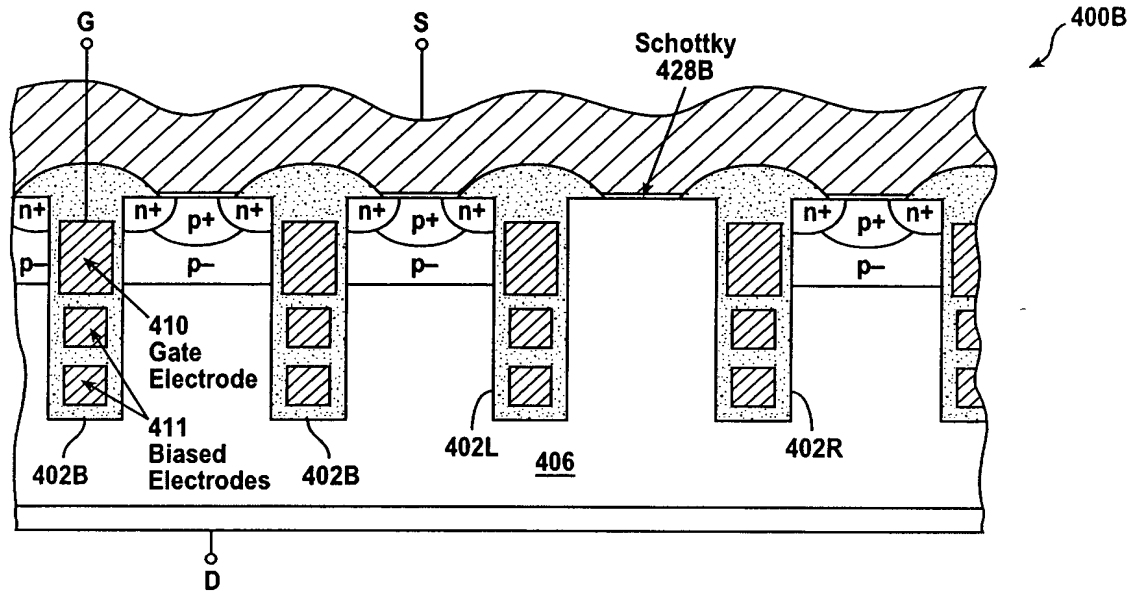


FIG. 4A

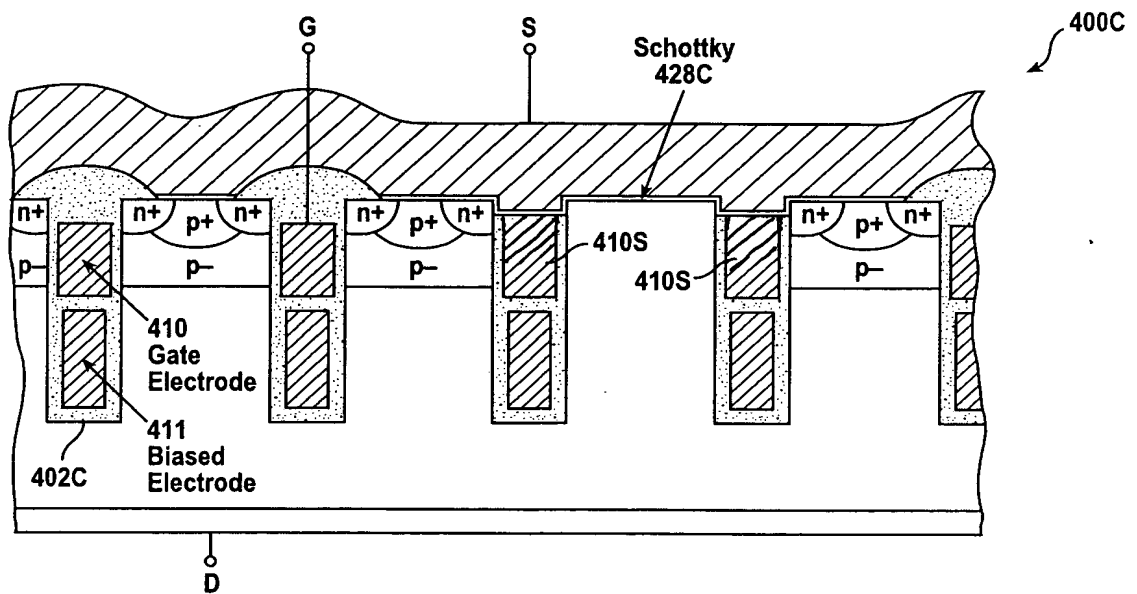


FIG. 4B

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A cross-sectional diagram of a Schottky MOSFET structure. The device features a p-type substrate (402C) with a series of p-n junctions (411 Biased Electrode) and Schottky contacts (416S). The gate electrode (414) is shown above the channel region, and the Schottky contact (428C) is located on the right side. The diagram is labeled with various components and their electrical characteristics.

FIG. 4B